Roller-Compacted Concrete Pavement

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RCC: A New Alternative

- Concrete pavement placed a different way
  - Zero slump
  - No forms
  - No dowels or reinforcing
  - No finishing
  - Vibratory compaction

Limitations of RCC

- RCC does not provide all the features of conventional concrete pavement
  - Surface texture and uniformity
  - Pavement smoothness
  - Aesthetics

Engineering Properties

- Compressive strength
  - 4,000 to 10,000 psi
- Flexure strength
  - 500 to 1,000 psi
  - $f_r = C(f'_c)^{1/2}$ where $C = 9$ (up to 11)
- Modulus of elasticity
  - 3,000,000 to 5,500,000 psi
  - $E = C_E(f'_c)^{1/2}$ where $C_E = 57,000$ (up to 67,000)

Thickness Design of RCC Pavements

- Design methods based on CTL and COE Research
- Follows rigid pavement design strategies
- Plain, undoweled, unreinforced concrete pavement

Mixture Design

- Dry enough to support vibratory roller
- Wet enough to permit adequate distribution of paste
Soil Compaction Method

- Determine moisture content
- Construct moisture/density curve
- Modified proctor ASTM D1557
- Assume a median cement content (e.g. 15%)

View Of Casting First Lift Of Cylinder Using ASTM C1435

Completed Test Cylinders

Strength vs. Cement Content

RCC Production
Batching & Mixing
Continuous Pug Mill
- High-volume applications
- Excellent mixing efficiency for dry materials
- 250 to 500+ tons/hr
- Mobile, erected on site
- Higher mobilization costs

Central Concrete Batch Plant
- Highly accurate proportioning
- Local availability
- Smaller output capacity
- Longer mix times than conventional concrete
- Frequent cleaning
- Dedicated production

Horizontal Shaft Batch Mixer
- Transporting
- Rear dump trucks normally used
- Minimize transport time
- Covers required for long hauls, or hot/windy conditions

Placing
- Layer thickness
  - 4 in. minimum
  - 8 in. maximum (10 in. with heavy-duty pavers)
- Timing sequence
  - Adjacent lanes placed within 60 minutes for "fresh joint"
  - Multiple lifts placed within 60 minutes for bond
- Production should match paver capacity
  - Continuous forward motion for best smoothness

Placing Equipment
- High density ABG pavers
  - Vibrating screed
  - Dual tamping bars
  - High initial density, 96-95%
  - Reduces subsequent compaction
  - High-volume placement (1,000 to 2,000 cubic yards per shift)
  - Designed for harsh mixes
  - Smoothest RCC surface
Access Provided Directly Behind the ABG Paver (Prior to Roller Compaction)

Placing Equipment
- Conventional Asphalt Pavers
  - Provides some initial density (80-85%)
  - Relatively smooth surface
  - May require modification
  - Increased cleaning and maintenance

Compaction
- Proper compaction is critical for strength and durability
- Compact to 98%
- Modified Proctor
- Vibratory roller
- Rubber-tire roller
- Non-vib steel wheel

Moisture/Density
- Nuclear Gauge
- ASTM C1040

Off-Highway Applications
- Log sort yards and haul roads
- Military applications
  - Tank hardstands
  - Maintenance yards
- Intermodal shipping
- Truck terminals/distribution centers
- Airfield apron areas
- Parking and storage

Louisiana Pacific
Tacoma, WA
BN Intermodal Yard, Denver 1986

35 Acres, Up to 20 in. Thick

Straddle Carrier

Norfolk International Terminal

Covenant Transport
Chattanooga, TN

New RCC

Existing Conventional Concrete

HONDA AMERICA - ALABAMA

ALL INTERIOR ROADS–RCC

30 FT WIDE-7" DEPTH

Streets and Highways

- Industrial access roads
- Residential streets
- Highway inlays
- Fast-track, high-volume intersections
- Shoulders and turn lanes

Columbus, Ohio City Streets
Arterial Roads

- Flexural Strength of 400 psi in 24 – 48 hrs
- Can surface within hours

Mill & Inlay - Mississippi

Before

During Inlay

Calgary Intersection

High-Volume Asphalt Intersection Milled and Replaced by RCC in 60-hour Weekend Construction

Residential Streets:
All-Weather Access

Thank You!

www.cement.org

pca